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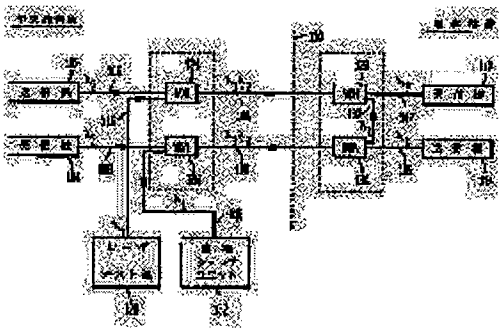
(54) SYSTEM AND METHOD FOR MONITORING OPTICAL LINK AND FOR SPECIFYING STATE OF THE LINK

(57)Abstract:

PROBLEM TO BE SOLVED: To specify or detect the soundness of an optical link by allowing a 2nd device to monitor the optical link, based on the received optical signal having the first wavelength and then detect the state of the optical link.



SOLUTION: An optical signal having wavelength λ1 is produced by a laser site source 120 and supplied to one of inputs of a WDM 124. Another optical signal having wavelength λ2 is received from a transmitter 102 and supplied to the other input of the WDM 124. Both optical signals of λ1 and λ2 are transmitted to an optical link 106 via the WDM 124. A transmitter 114 produces an optical signal having wavelength λ3, which is supplied to one of inputs of a WDM 130. The optical signals of λ1 and λ3 are transmitted to a central station via the WDM 130 and then to a system optical link 108. In

this way, the signals λ2 and λ3 are used by a system, and its users for communication and the signal of λ1 is used to monitor both links 106 and 108 and to detect the states of these links.

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CLAIMS

[Claim(s)]
[Claim 1]It is a system for specifying a state of an optical link of a communications system, A lightwave signal in which these lightwave signals are carried via an optical link (106, 108), and these lightwave signals have the first wavelength (lambda$_1$) including the first device (126) with which :lightwave signal is transmitted and received for this system through it, comprising other lightwave signals with different wavelength (lambda$_2$, lambda$_3$) from this first wavelength --; -- this system including the second device (122) further combined with said first device, A system, wherein this second device specifies a state of these optical links based on a received lightwave signal with said first wavelength.
[Claim 2]said -- others -- wavelength of a lightwave signal fully differs from said first wavelength -- this sake -- said -- others -- a system of claim 1 not causing interference with big lightwave signal and lightwave signal with said first wavelength.
[Claim 3]A system of claim 1, wherein said first device is a wavelength division multiplexer (126).
[Claim 4]A system of claim 1 which said second device is a surveillance shelf unit (122), and is characterized by comprising that this surveillance shelf YUNIDDO receives and analyzes a lightwave signal with said first wavelength so that degradation of a signal may be detected.
[Claim 5]A system of claim 1, wherein said first device is combined with said second device using an optical link (118).
[Claim 6]A system of claim 1 using in order to set up a standard effective in being constituted so that said second device may carry out a statistical analysis about an optical link, and this result reducing failure of a link, and reducing generating of degradation of a signal.
[Claim 7]It is a system for specifying a state of an optical link of a communications system, first [at least] optical link (106); in which this system has the :first end, and the second end -- including second [at least] optical link (108); and the first wavelength division multiplexer

(124) with the first end and second end, different wavelength (lambda --) from at least one lightwave signal with the first wavelength (lambda$_1$), and this first wavelength through this [$_2$ and] a lightwave signal including other lightwave signals with lambda$_3$ is transmitted and received, and this first wavelength division multiplexer (124) is connected to the first end of said first optical link --; -- this system including the second wavelength division multiplexer (128) by which said lightwave signal is further transmitted and received through it, this second wavelength division multiplexer (128) is connected to the second end of said first optical link --; -- this system including the third wavelength division multiplexer (130) by which a lightwave signal is further transmitted and received through it, It is connected to the second end of said second optical link by this third wavelength division multiplexer (130), and this one input, Said second wavelength division multiplexer. being combined with one output of (128) --; -- this system including a surveillance shelf unit (122) combined with one output of wavelength division multiplexer [of ** the fourth further connected to the first end of said second optical link] (126);, and said fourth wavelength division multiplexer, A system characterized by said thing [being constituted so that the first and the second optical link may be supervised at least and a state may be specified] because this surveillance shelf unit (122) receives and analyzes said at least one lightwave signal with said first wavelength (lambda$_1$).

[Claim 8]Said second wavelength division multiplexer (128) a lightwave signal from said first optical link (106), A system of claim 7 constituting via an optical link connected between one output of said second wavelength division multiplexer (128), and one input of said third wavelength division multiplexer (130) so that it may act to said second optical link (108) as loopback.

[Claim 9]A system of claim 7, wherein said surveillance shelf unit (122) is combined with one output of said fourth wavelength division multiplexer (126) via an optical link (118).

[Claim 10]It is a method for specifying a state of an optical link of a communications system, A step which transmits other lightwave signals with different wavelength from at least one lightwave signal in which this method has the :first wavelength, and this first wavelength to at least one optical link; at least one lightwave signal with said first wavelength via another optical link. A system characterized by including said at least one optical link and said step which supervises another optical link at least and specifies a state of these links by analyzing at least one lightwave signal with step; which receives, and said first wavelength.

[Claim 11]A method of claim 10, wherein a step which transmits other lightwave signals with different wavelength from at least one lightwave signal with said first wavelength and this first wavelength contains a step which transmits said lightwave signal to said at least one optical link through a wavelength division multiplexer.

[Claim 12]A method of claim 10 containing a step which receives other lightwave signals in

which a step which receives said at least one lightwave signal has different wavelength from said first wavelength further.

[Claim 13]A method of claim 12, wherein a step which receives other lightwave signals with different wavelength from at least one lightwave signal with said first wavelength and this first wavelength contains a step which passes these lightwave signals to a receiver through a wavelength division multiplexer (for example, 126, 128).

[Claim 14]A method of claim 10 containing a step which detects degradation of at least one lightwave signal in which a step which analyzes at least one lightwave signal with said first wavelength has said first wavelength further.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]More, this invention is in the surveillance of an optical communication link, and the state where signal transmission is simultaneously carried through these links, supervises the optical link in a communications system in details, and relates to the system and method for detecting the state of these links (a link is characteristic-ized).
[0002]
[Description of the Prior Art]Using an optical link, a communications system is between various equipment in a system, is carrying signal transmission, and often provides communications service for a user. The optical-communications signal (it is henceforth called a "lightwave signal") with which an optical link expresses data, video, sound, and the information on other types through this including at least one optical fiber is carried. Typically, the provider of a communications system owns the related equipment connected to these optical links and these links. Drawing 1 shows the communications system 100 as an example which uses an optical link, in order to carry a lightwave signal between the central office and a customer site. For lucidity, it indicates the central office that only one customer site is connected. However, in addition to a actual communications system including such a customer site of hundreds of and what 1000, for example, various remote terminal equipment sites exist over this whole communications system.
[0003]The communications system 100 contains system provider equipment and a customer facility, and these are owned and controlled by the system provider and a customer, respectively. The boundary line 110 shows symbolically a certain type between user equipments and system provider equipment of physical boundary. This boundary line 110 identifies equipment with the function which combines system provider equipment with a customer facility (it expresses). For example, the boundary line 110 expresses a certain type of

envelopment (not shown), for example, a network interface unit, the optical link from a communications system carries out a termination into this network interface unit, and these optical links are combined with the optical link from a customer. That is, the termination also of the optical link from a customer is carried out to this lightwave interface unit. This network interface unit is arranged near a customer site or a customer site.

[0004]The transmitter 102 transmits a lightwave signal to a customer facility via the optical links 106 and 107. The receiver 104 receives the lightwave signal from a customer facility via the optical links 108 and 109. In a customer site, it is received by the receiver 112 and a lightwave signal is transmitted by the transmitter 114. The optical links 107 and 109 are owned and controlled by a customer, and are usually called a local link. The optical links 106 and 108 are called a system optical link here. The lightwave signal which is a place of a customer site and the central office, and was received typically is changed into an electrical signal, and these are processed by the electronic circuit (not shown).

[0005]the optical link (a system link and a local link) in a communications system where degradation of a lightwave signal is often specific, or a group -- it generates in the place of a link (a system link and a local link). It has an adverse effect on the quality of the lightwave signal carried through a communications system as various factors or states indicate to be degradation of a signal, for example to drawing 1, and is defined as being in a situation which comprehension of communication of becomes impossible as a result, or is set to the level which cannot permit the error ratio of a received light signal. Generating of degradation of a signal will often suspect the soundness of a specific system link. The soundness of a certain optical link has a physical condition of a link, the physical property of a link, the whole link, or the topology of a link segment as an example of these factors that contribute to the normal function of an optical link with regards to many factors which contribute to the normal function of an optical link, for example. Specification (characteristic-izing) of the state of an optical link is performed based on the soundness of these links. For example, a certain optical link is pinpointed with an unusual thing, when it is detected that it is in the state (for example, the state which the link segment damaged, the state where some optical characteristics of a link are inferior) which is physically inferior where a certain point on the link causes degradation of a signal (discernment).

[0006]When the soundness of a certain specific optical link is a problem, the system provider needs to determine whether the cause of degradation of the signal is in a system optical link, it is in a local link, or it is in a customer facility (detection). In order to trace the cause of degradation of a signal, it is necessary to cut a certain system optical link and to analyze this in manual operation, by the craftsman currently employed by the system provider. For cutting of a system optical link, it is necessary temporarily to separate each optical fiber of a system optical link on one or more points, or to cut these fibers at some connection points. In this way, the

fiber separated or cut by a craftsman. if it becomes clear that it is tested individually and that fiber is once functioning normally -- the remaining portion of it link -- SUPURASUI -- namely, -- re connection is carried out --; -- this procedure is repeated until the test of the whole system optical link finishes. Analyzing and testing a system optical link by an above-mentioned method not only requires cost and time, but only the time period when service to a customer is indefinite is interrupted in the midst of this test. When it is found in many cases that degradation of a signal is the abnormalities of a local link and failure of a customer facility, it turns out that such a test was not actually required later.

[0007]

[Problem(s) to be Solved by the Invention]By therefore, the thing for which it is not necessary to interrupt service to the customer of a communications system, and to analyze [do not need to separate and test each fiber in an optical link, and] it, and the optical link of a communications system is supervised. The necessity of receiving the method effective in cost of specifying or detecting the soundness of these optical links exists.

[0008]

[Means for Solving the Problem]Using a test signal which does not give interference to signal transmission currently carried through a communications system, this invention supervises an optical link of a communications system, and indicates a system and a method for detecting a state of these optical links (discernment). A system by this invention contains the first device with which a lightwave signal is transmitted and received through it. A lightwave signal currently carried via an optical link comprises a lightwave signal with the first wavelength, and other lightwave signals with different wavelength from this first wavelength. Including the second device with which this system was further combined with said first device, based on a received lightwave signal with the first wavelength, this second device supervises an optical link, and it is constituted so that this state may be detected (discernment).

[0009]

[Embodiment of the Invention]Drawing 2 shows this invention realized in a communications system. According to this invention, a wavelength division multiplexer (124, 126, 128, 130) is connected to the both ends of the system optical links 106 and 108, A test signal with the first wavelength is carried via the optical links 106 and 108, and it is carried, without interfering in other lightwave signals with simultaneously different wavelength from this first wavelength with a test signal via the optical links 106 and 108, and by this. A system optical link (106, 108) is supervised using the surveillance shelf unit 122 connected to WDM126 via the optical link 118, and it becomes possible to detect this state. Although it is shown by here that a customer facility is connected to central office equipment via two one-way optical links (106, 108), a customer facility is also connectable with central office equipment in one or more one ways or bidirectional optical links so that he can understand easily.

[0010]A wavelength division multiplex multiplexer (WDM) has at least one input and at least one output, the lightwave signal of various wavelength is received and transmitted through these, and these lightwave signals are devices processed in mutually-independent (amplification, attenuation, combination, separation). The combination of other devices or a device constituted so that these functions of a wavelength division multiplexer might be carried out can also be used so that he can understand easily. Various lightwave signals explained here for saving of a text and conciseness are expressed by those wavelength lambda$_n$ henceforth.

[0011]Explanation is continued to drawing 2, the source 120 of a laser test generates a lightwave signal with wavelength lambda$_1$, and this lightwave signal is supplied to the input of WDM124. Other lightwave signals of wavelength lambda$_2$ from the transmitter 102 are supplied to another input of WDM124. Both signals (lambda$_1$, lambda$_2$) are transmitted on the optical link 106 through WDM124. These signals are received by WDM128, WDM128 passes signal lambda$_2$ to the receiver 112 via the local link 107, and the route of the signal lambda$_1$ is carried out to the input of WDM130 via the loopback link 132. The transmitter 114 generates the lightwave signal of wavelength lambda$_3$, and this signal is supplied to another input of WDM130. These signals (lambda$_1$, lambda$_3$) are transmitted to the central office via the system optical link 108 through WDM130. In order that some communications systems may transmit and receive two or more lightwave signals which have equal wavelength identically or substantially, signal lambda$_2$ may have equal wavelength identically or substantially with signal lambda$_3$. In this way, signal lambda$_2$ and lambda$_3$ are used by a system and its user for communication, and signal lambda$_1$ supervises the system optical links 106 and 108, and it is used in order to detect this state (for characteristic-izing of a system optical link).

[0012]Since signal lambda$_1$ and signal lambda$_3$ fully differ so that interference may not exist substantially between the signals in which these wavelength is these two although they are simultaneously carried through the system optical link 108, the big interaction between these which cause degradation of a serious signal is eliminated. Similarly, an interaction almost or completely does not exist between signal lambda$_1$ and signal lambda$_2$ which are simultaneously carried through the system optical link 106. WDM126 receives a lightwave signal (lambda$_1$, lambda$_3$) from WDM130, and passes signal lambda$_1$ to the surveillance shelf unit 122 via the link 118. WDM126 passes signal lambda$_3$ to the receiver 104 via the link 108. it can be [understand easily in a person skilled in the art] alike, and two or more lightwave signals which have two or more wavelength for a transmitter (102, 114) can be transmitted,

and a receiver (104, 112) can also be constituted so that the lightwave signal of the wavelength of these plurality may be received. In this case, the signal of the wavelength of these plurality is chosen so that these may not interfere with test signal lambda$_1$ substantially.

[0013]The surveillance shelf unit 122 has the equipment which can detect where [in degradation and the system optical link of a well-known signal] the degradation occurred in the person skilled in the art. The surveillance shelf unit 122 detects degradation of a signal by supervising, after this signal spreads test signal lambda$_1$ in a system optical link. The deterioration cause of a signal can also be known by analyzing received test signal lambda$_1$ in addition to the surveillance shelf unit 122 having the capability to detect degradation of a signal. In this way, the surveillance shelf unit 122 can do what (a system optical link is characteristic-ized) the state of a system optical link is specified for based on received lightwave signal lambda$_1$ using the technique of various common knowledge. For example, based on received signal lambda$_1$ the surveillance shelf unit 122, When degradation of a signal is detected and it is specified that the cause is superfluous attenuation of the lightwave signal in a certain point in the system optical link 108, the state of the system optical links 106 and 108 is characteristic-ized with what is a last-minute function state (it specifies). Degradation of the detected signal may be characteristic-ized with that which is because the customer facility is not functioning correctly (specific). In addition, the generation times of the grade of degradation of a signal and the signal deterioration of a certain optical link can be document-ized, and the surveillance shelf unit 122 can also record the number of times of the failure generated in the specific optical link in a certain time period. The route also of the lightwave signal lambda$_3$ is carried out to the receiver 104 via the link 108. Therefore, communicating through a customer facility and an optical link, simultaneously, the central office equipment can supervise these optical links, and can know the soundness of these communication links, and the cause and position of signal deterioration on continuous, intermittent, a periodic target, or a non-cycle target.

[0014]The surveillance shelf unit 122 is original, Or in collaboration with a central processing unit, they are SHISUTE light Lynn Qum and/, or a local optical link (). [get blocked and] The statistical analysis of some segments of one link, some links of two or more, and one or more links can be carried out, and the short-term history (for example, [a time exception, Japanese another one, a circumferential exception, monthly]) of the soundness of a system optical link can be acquired. In this way, for example, once the degradation state of a signal is detected, the surveillance shelf unit 122 will be recorded about the state of the optical link which generation times, the generating scale, and the signal deterioration state generated. A customer and/, or the system provider can know which [of these entities (a customer / system

provider)] is the cause of generating of signal deterioration by analyzing the information recorded in this way. In this way, a system provider and/, or the customer can carry out a statistical analysis about some of segments of a link, all the links, and communications systems using a surveillance shelf unit. This statistical analysis carried out with a surveillance shelf unit can be conducted automatically, without dispatching a craftsman, for this reason can reduce the maintenance cost relevant to a system. The standard (for example, whether if it breaks down how many times, that link segment will be exchanged and a standard) which is useful to reduce generating of link failure and to reduce generating of signal deterioration as a result using the result of this statistical analysis can be set up.

[0015]It shifts to explanation of drawing 3, and WDM 128 and 130 is arranged at the system side of boundary RANI 110, and is owned by the system provider. In this composition, expense of the test equipment (WDM 128 and 130, loopback link 132) needed in order that a customer may carry out this invention is not needed, and, for this reason, equipment is put under a system provider's control and possession. This test equipment is arranged in the suitable position which can be accessed at both a system link (106, 108) and a local link (107, 109).

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TECHNICAL FIELD

[Field of the Invention]More, this invention is in the surveillance of an optical communication link, and the state where signal transmission is simultaneously carried through these links, supervises the optical link in a communications system in details, and relates to the system and method for detecting the state of these links (a link is characteristic-ized).

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PRIOR ART

[Description of the Prior Art]Using an optical link, a communications system is between various equipment in a system, is carrying signal transmission, and often provides communications service for a user. The optical-communications signal (it is henceforth called a "lightwave signal") with which an optical link expresses data, video, sound, and the information on other types through this including at least one optical fiber is carried. Typically, the provider of a communications system owns the related equipment connected to these optical links and these links. Drawing 1 shows the communications system 100 as an example which uses an optical link, in order to carry a lightwave signal between the central office and a customer site. For lucidity, it indicates the central office that only one customer site is connected. However, in addition to a actual communications system including such a customer site of hundreds of and what 1000, for example, various remote terminal equipment sites exist over this whole communications system.

[0003]The communications system 100 contains system provider equipment and a customer facility, and these are owned and controlled by the system provider and a customer, respectively. The boundary line 110 shows symbolically a certain type between user equipments and system provider equipment of physical boundary. This boundary line 110 identifies equipment with the function which combines system provider equipment with a customer facility (it expresses). For example, the boundary line 110 expresses a certain type of envelopment (not shown), for example, a network interface unit, the optical link from a communications system carries out a termination into this network interface unit, and these optical links are combined with the optical link from a customer. That is, the termination also of the optical link from a customer is carried out to this lightwave interface unit. This network interface unit is arranged near a customer site or a customer site.

[0004]The transmitter 102 transmits a lightwave signal to a customer facility via the optical links 106 and 107. The receiver 104 receives the lightwave signal from a customer facility via

the optical links 108 and 109. In a customer site, it is received by the receiver 112 and a lightwave signal is transmitted by the transmitter 114. The optical links 107 and 109 are owned and controlled by a customer, and are usually called a local link. The optical links 106 and 108 are called a system optical link here. The lightwave signal which is a place of a customer site and the central office, and was received typically is changed into an electrical signal, and these are processed by the electronic circuit (not shown).

[0005]the optical link (a system link and a local link) in a communications system where degradation of a lightwave signal is often specific, or a group -- it generates in the place of a link (a system link and a local link). It has an adverse effect on the quality of the lightwave signal carried through a communications system as various factors or states indicate to be degradation of a signal, for example to drawing 1, and is defined as being in a situation which comprehension of communication of becomes impossible as a result, or is set to the level which cannot permit the error ratio of a received light signal. Generating of degradation of a signal will often suspect the soundness of a specific system link. The soundness of a certain optical link has a physical condition of a link, the physical property of a link, the whole link, or the topology of a link segment as an example of these factors that contribute to the normal function of an optical link with regards to many factors which contribute to the normal function of an optical link, for example. Specification (characteristic-izing) of the state of an optical link is performed based on the soundness of these links. For example, a certain optical link is pinpointed with an unusual thing, when it is detected that it is in the state (for example, the state which the link segment damaged, the state where some optical characteristics of a link are inferior) which is physically inferior where a certain point on the link causes degradation of a signal (discernment).

[0006]When the soundness of a certain specific optical link is a problem, the system provider needs to determine whether the cause of degradation of the signal is in a system optical link, it is in a local link, or it is in a customer facility (detection). In order to trace the cause of degradation of a signal, it is necessary to cut a certain system optical link and to analyze this in manual operation, by the craftsman currently employed by the system provider. For cutting of a system optical link, it is necessary temporarily to separate each optical fiber of a system optical link on one or more points, or to cut these fibers at some connection points. In this way, the fiber separated or cut by a craftsman. if it becomes clear that it is tested individually and that fiber is once functioning normally -- the remaining portion of it link -- SUPURASUI -- namely, -- re connection is carried out --; -- this procedure is repeated until the test of the whole system optical link finishes. Analyzing and testing a system optical link by an above-mentioned method not only requires cost and time, but only the time period when service to a customer is indefinite is interrupted in the midst of this test. When it is found in many cases that degradation of a signal is the abnormalities of a local link and failure of a customer facility, it

turns out that such a test was not actually required later.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]By therefore, the thing for which it is not necessary to interrupt service to the customer of a communications system, and to analyze [do not need to separate and test each fiber in an optical link, and] it, and the optical link of a communications system is supervised. The necessity of receiving the method effective in cost of specifying or detecting the soundness of these optical links exists.

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MEANS

[Means for Solving the Problem]Using a test signal which does not give interference to signal transmission currently carried through a communications system, this invention supervises an optical link of a communications system, and indicates a system and a method for detecting a state of these optical links (discernment). A system by this invention contains the first device with which a lightwave signal is transmitted and received through it. A lightwave signal currently carried via an optical link comprises a lightwave signal with the first wavelength, and other lightwave signals with different wavelength from this first wavelength. Including the second device with which this system was further combined with said first device, based on a received lightwave signal with the first wavelength, this second device supervises an optical link, and it is constituted so that this state may be detected (discernment).
[0009]
[Embodiment of the Invention]Drawing 2 shows this invention realized in a communications system. According to this invention, a wavelength division multiplexer (124, 126, 128, 130) is connected to the both ends of the system optical links 106 and 108, A test signal with the first wavelength is carried via the optical links 106 and 108, and it is carried, without interfering in other lightwave signals with simultaneously different wavelength from this first wavelength with a test signal via the optical links 106 and 108, and by this. A system optical link (106, 108) is supervised using the surveillance shelf unit 122 connected to WDM126 via the optical link 118, and it becomes possible to detect this state. Although it is shown by here that a customer facility is connected to central office equipment via two one-way optical links (106, 108), a customer facility is also connectable with central office equipment in one or more one ways or bidirectional optical links so that he can understand easily.
[0010]A wavelength division multiplex multiplexer (WDM) has at least one input and at least one output, the lightwave signal of various wavelength is received and transmitted through these, and these lightwave signals are devices processed in mutually-independent

(amplification, attenuation, combination, separation). The combination of other devices or a device constituted so that these functions of a wavelength division multiplexer might be carried out can also be used so that he can understand easily. Various lightwave signals explained here for saving of a text and conciseness are expressed by those wavelength lambda$_n$ henceforth.

[0011]Explanation is continued to drawing 2, the source 120 of a laser test generates a lightwave signal with wavelength lambda$_1$, and this lightwave signal is supplied to the input of WDM124. Other lightwave signals of wavelength lambda$_2$ from the transmitter 102 are supplied to another input of WDM124. Both signals (lambda$_1$, lambda$_2$) are transmitted on the optical link 106 through WDM124. These signals are received by WDM128, WDM128 passes signal lambda$_2$ to the receiver 112 via the local link 107, and the route of the signal lambda$_1$ is carried out to the input of WDM130 via the loopback link 132. The transmitter 114 generates the lightwave signal of wavelength lambda$_3$, and this signal is supplied to another input of WDM130. These signals (lambda$_1$, lambda$_3$) are transmitted to the central office via the system optical link 108 through WDM130. In order that some communications systems may transmit and receive two or more lightwave signals which have equal wavelength identically or substantially, signal lambda$_2$ may have equal wavelength identically or substantially with signal lambda$_3$. In this way, signal lambda$_2$ and lambda$_3$ are used by a system and its user for communication, and signal lambda$_1$ supervises the system optical links 106 and 108, and it is used in order to detect this state (for characteristic-izing of a system optical link).

[0012]Since signal lambda$_1$ and signal lambda$_3$ fully differ so that interference may not exist substantially between the signals in which these wavelength is these two although they are simultaneously carried through the system optical link 108, the big interaction between these which cause degradation of a serious signal is eliminated. Similarly, an interaction almost or completely does not exist between signal lambda$_1$ and signal lambda$_2$ which are simultaneously carried through the system optical link 106. WDM126 receives a lightwave signal (lambda$_1$, lambda$_3$) from WDM130, and passes signal lambda$_1$ to the surveillance shelf unit 122 via the link 118. WDM126 passes signal lambda$_3$ to the receiver 104 via the link 108.

it can be [understand easily in a person skilled in the art] alike, and two or more lightwave signals which have two or more wavelength for a transmitter (102, 114) can be transmitted, and a receiver (104, 112) can also be constituted so that the lightwave signal of the wavelength of these plurality may be received. In this case, the signal of the wavelength of these plurality is chosen so that these may not interfere with test signal lambda$_1$ substantially.

[0013]The surveillance shelf unit 122 has the equipment which can detect where [in degradation and the system optical link of a well-known signal] the degradation occurred in the person skilled in the art. The surveillance shelf unit 122 detects degradation of a signal by supervising, after this signal spreads test signal lambda$_1$ in a system optical link. The deterioration cause of a signal can also be known by analyzing received test signal lambda$_1$ in addition to the surveillance shelf unit 122 having the capability to detect degradation of a signal. In this way, the surveillance shelf unit 122 can do what (a system optical link is characteristic-ized) the state of a system optical link is specified for based on received lightwave signal lambda$_1$ using the technique of various common knowledge. For example, based on received signal lambda$_1$ the surveillance shelf unit 122, When degradation of a signal is detected and it is specified that the cause is superfluous attenuation of the lightwave signal in a certain point in the system optical link 108, the state of the system optical links 106 and 108 is characteristic-ized with what is a last-minute function state (it specifies). Degradation of the detected signal may be characteristic-ized with that which is because the customer facility is not functioning correctly (specific). In addition, the generation times of the grade of degradation of a signal and the signal deterioration of a certain optical link can be document-ized, and the surveillance shelf unit 122 can also record the number of times of the failure generated in the specific optical link in a certain time period. The route also of the lightwave signal lambda$_3$ is carried out to the receiver 104 via the link 108. Therefore, communicating through a customer facility and an optical link, simultaneously, the central office equipment can supervise these optical links, and can know the soundness of these communication links, and the cause and position of signal deterioration on continuous, intermittent, a periodic target, or a non-cycle target.

[0014]The surveillance shelf unit 122 is original, Or in collaboration with a central processing unit, they are SHISUTE light Lynn Qum and/, or a local optical link (). [get blocked and] The statistical analysis of some segments of one link, some links of two or more, and one or more links can be carried out, and the short-term history (for example, [a time exception, Japanese another one, a circumferential exception, monthly]) of the soundness of a system optical link can be acquired. In this way, for example, once the degradation state of a signal is detected, the surveillance shelf unit 122 will be recorded about the state of the optical link which generation times, the generating scale, and the signal deterioration state generated. A customer and/, or the system provider can know which [of these entities (a customer / system provider)] is the cause of generating of signal deterioration by analyzing the information recorded in this way. In this way, a system provider and/, or the customer can carry out a statistical analysis about some of segments of a link, all the links, and communications systems using a surveillance shelf unit. This statistical analysis carried out with a surveillance

shelf unit can be conducted automatically, without dispatching a craftsman, for this reason can reduce the maintenance cost relevant to a system. The standard (for example, whether if it breaks down how many times, that link segment will be exchanged and a standard) which is useful to reduce generating of link failure and to reduce generating of signal deterioration as a result using the result of this statistical analysis can be set up.

[0015]It shifts to explanation of drawing 3, and WDM 128 and 130 is arranged at the system side of boundary RANI 110, and is owned by the system provider. In this composition, expense of the test equipment (WDM 128 and 130, loopback link 132) needed in order that a customer may carry out this invention is not needed, and, for this reason, equipment is put under a system provider's control and possession. This test equipment is arranged in the suitable position which can be accessed at both a system link (106, 108) and a local link (107, 109).

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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DESCRIPTION OF DRAWINGS

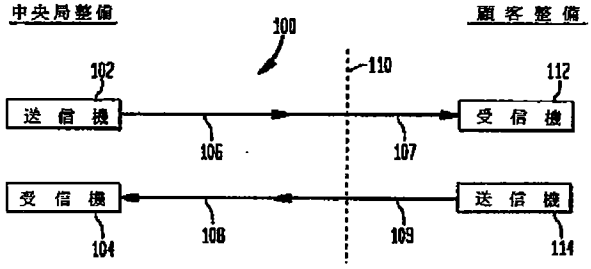
[Brief Description of the Drawings]
[Drawing 1]A system level shows the communications system by a Prior art with an optical communication link.
[Drawing 2]This invention integrated in a communications system is shown.
[Drawing 3]A part of customer site of drawing 2 in case all the test equipment is owned and controlled by a system provider is shown.
[Description of Notations]
106 and 108 System optical link
107 and 109 Local optical link
124, 126, 128, and 130 Wavelength division multiplexer (WDM)
120 The source of a laser test
122 Surveillance shelf unit
132 Loopback link

[Translation done.]

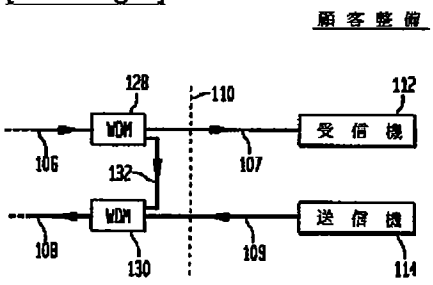
* NOTICES *

DRAWINGS

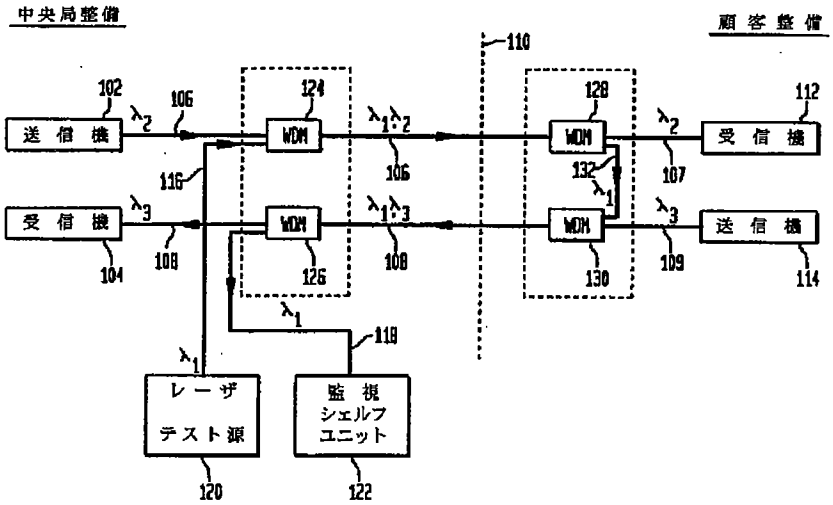
[Drawing 1]



[Drawing 3]



[Drawing 2]



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CORRECTION OR AMENDMENT

[Kind of official gazette]Printing of amendment by the regulation of 2 of Article 17 of Patent Law

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3/46 B

9/00 E

[Written amendment]
[Filing date]May 24, Heisei 12 (2000.5.24)

[Amendment 1]
[Document to be Amended]Specification
[Item(s) to be Amended]Claim
[Method of Amendment]Change
[Proposed Amendment]
[Claim(s)]
[Claim 1]It is a system for supervising and specifying, and this system an optical link of a communications system :
A lightwave signal in which these lightwave signals are carried via an optical link (106, 108), and these lightwave signals have the first wavelength (lambda$_1$) including the first device (126) with which a lightwave signal is transmitted and received through it, comprising other lightwave signals with different wavelength (lambda$_2$, lambda$_3$) from this first wavelength --; -- this system -- further
A system constituted including the second device (122) combined with said first device so that this second device may supervise and pinpoint these optical links based on a received lightwave signal with said first wavelength.
[Claim 2]said -- others -- wavelength of a lightwave signal fully differs from said first wavelength -- this sake -- said -- others -- a system of claim 1 not causing interference with big lightwave signal and lightwave signal with said first wavelength.
[Claim 3]A system of claim 1, wherein said first device is a wavelength division multiplexer (126).
[Claim 4]A system of claim 1 which said second device is a surveillance shelf unit (122), and is characterized by this surveillance shelf unit comprising receiving and analyzing a lightwave signal with said first wavelength so that degradation of a signal may be detected.
[Claim 5]A system of claim 1, wherein said first device is combined with said second device using an optical link (118).
[Claim 6]A system of claim 1 using in order to set up a standard effective in being constituted so that said second device may carry out a statistical analysis about an optical link, and this result reducing failure of a link, and reducing generating of degradation of a signal.
[Claim 7]It is a system for supervising and specifying, and this system an optical link of a communications system :
First at least one optical link (106) with the first end and second end;
second at least one optical link (108); with the first end and second end -- and
This first wavelength division multiplexer is led including the first wavelength division multiplexer (124), different wavelength (lambda --) from at least one lightwave signal with the first wavelength (lambda$_1$), and this first wavelength [$_2$ and] a lightwave signal including other

lightwave signals with lambda$_3$ is transmitted and received, and this first wavelength division multiplexer (124) is connected to the first end of said first optical link --; -- this system -- further this second wavelength division multiplexer (128) is connected to the second end of said first optical link including the second wavelength division multiplexer (128) by which said lightwave signal is transmitted and received through it --; -- this system -- further
The third wavelength division multiplexer (130) by which a lightwave signal is transmitted and received through it is included, this third wavelength division multiplexer (130) is connected to the second end of said second optical link, and this one input is combined with one output of said second wavelength division multiplexer (128) --; -- this system -- further
wavelength division multiplexer [of ** the fourth connected to the first end of said second optical link] (126); -- and
A surveillance shelf unit (122) combined with one output of said fourth wavelength division multiplexer is included, A system characterized by said thing [being constituted so that the first and the second optical link may be supervised at least and a state may be specified] because this surveillance shelf unit (122) receives and analyzes said at least one lightwave signal with said first wavelength (lambda$_1$).

[Claim 8]Said second wavelength division multiplexer via an optical link connected between one output of said second wavelength division multiplexer, and one input of said third wavelength division multiplexer, A system of claim 7 constituting so that it may act to said second optical link (108) as loopback of the lightwave signal from said first optical link (106).
[Claim 9]A system of claim 7, wherein said surveillance shelf unit is combined with one output of said fourth wavelength division multiplexer using an optical link (118).
[Claim 10]It is a method for supervising and specifying, and this method an optical link of a communications system :
A step which transmits other lightwave signals with different wavelength from at least one lightwave signal with the first wavelength, and this first wavelength to at least one optical link;
A step which receives said at least one lightwave signal via another optical link; it reaches.
A system characterized by including said at least one optical link and said step which supervises another optical link at least and specifies a state of these links by analyzing said at least one lightwave signal.
[Claim 11]A method of claim 10, wherein a step which transmits other lightwave signals with different wavelength from at least one lightwave signal with said first wavelength and this first wavelength contains a step which transmits said lightwave signal to said at least one optical link through a wavelength division multiplexer.
[Claim 12]A method of claim 10 containing a step which receives other lightwave signals in which a step which receives said at least one lightwave signal has different wavelength from said first wavelength further.

[Claim 13]A step which receives other lightwave signals with different wavelength from at least one lightwave signal with said first wavelength and this first wavelength, A method of claim 12 containing a step which makes a receiver pass these lightwave signals through a wavelength division multiplexer (for example, 126, 128).
[Claim 14]A method of claim 10, wherein a step which analyzes said at least one lightwave signal contains a step which detects all degradation of said at least one lightwave signal further.

[Translation done.]